※注意事項：必須用 2B 鉛筆作答，修正請用橡皮擦，答題前請先詳細閱讀答案卡上之畫記說明。

選擇題：單選

1. vitamin A _____ blood clotting
   vitamin D _____ vision
   vitamin E _____ Ca^{+2} and phosphate metabolism
   vitamin K _____ prevention of oxidative damage
   Please match the vitamins on the left with the role they play listed on the right :
   A) K, A, D, E
   B) E, A, D, K
   C) K, A, E, D
   D) A, D, K, E
   E) D, E, A, K
   (the order for answer is from top to bottom)

2. Which of the following lipids are not found in animal membranes?
   A) Phosphoglycerides
   B) Cholesterols
   C) Glycolipids
   D) Tiacylglycerols
   E) Shingolipids

3. Which of the following statements concerning fatty acids is correct?
   A) One is the precursor of vitamin A
   B) Phosphatidic acid is a common one
   C) They all contain one or more double bonds
   D) They are a constituent of sterols.
   E) Unsaturated fatty acids have lower melting points than saturated one.

4. Which of the following statements is consistent with what is known about membranes?
   A) Covalent bonding takes place between lipids and proteins in most membranes.
   B) Membranes don't contain glycolipids and glycoproteins
   C) The compositions of the inner and outer lipid layers are the same in any individual membrane.
   D) Lipid bilayers are an important component of membranes.
   E) A membrane consists of a layer of proteins sandwiched between two layers of lipids.

5. Which statement is consistent with the known facts about membrane transport?
   A) All transpsort systems are involved in the consumption of energy.
   B) Active transport moves a substance from a region where its concentration is lower to one where its concentration is higher.
   C) Facilitated diffusion needs some kind of carrier protein(s) and ATP as energy source.
   D) Active transports don't need any energy.
   E) Facilitated diffusion can establish a concentration gradient.

接背面

D) Transcription activation and repression

E) *Zinc fingers*

49. Which statement is incorrect about translational regulation in eukaryotic mRNAs?

A) Translational regulation may play an important role in regulating very long eukaryotic genes.

B) Some proteins bind directly to 3'UTR of mRNA and act as translational repressors.

C) Translational initiaion factor eIF2 can be phosphorylated to activate translation.

D) Binding proteins 4E-BPs are inactivated by protein phosphorylation.

E) micro-RNAs are known to inhibit translation.

50. In the development of the fly *Drosophila,* homeotic genes:

A) are transcribed during egg production; their mRNAs lie dormant in the egg until it is fertilized.

B) determine the number of body segments that will form.

C) are expressed late and determine the detailed structure of each body segment.

D) generally have no introns.

E) are not translated into proteins.

6. Which statement is consistent with the fluid mosaic model of membrane?
   A) All the membrane proteins are bound to the interior of the membrane.
   B) The term "mosaic" refers to the arrangement of the lipids alone.
   C) Carbohydrates are covalently bonded to the outside of the membrane.
   D) Both proteins and lipids undergo transverse (flip-flop) diffusion from the inside to the outside of the membrane.
   E) All proteins and lipids can not undergo lateral diffusion along the inner or outer surface of the membrane.

7. Movement of water across membranes is facilitated by proteins called:
   A) gramicidin
   B) aquaporins
   C) ionophore
   D) selectins
   E) lectins

8. When a bacterium such as *E. coli* is shifted from a warmer growth temperature to a cooler growth temperature, it compensates by:
   A) increasing its metabolic rate to generate more heat.
   B) putting longer-chain fatty acids into its membranes.
   C) putting more unsaturated fatty acids into its membranes.
   D) shifting from aerobic to anaerobic metabolism.
   E) synthesizing thicker membranes to insulate the cell.

9. The fluidity of a lipid bilayer will be increased by:
   A) decreasing the number of unsaturated fatty acids
   B) decreasing the temperature
   C) increasing the length of the alkyl chains
   D) increasing the temperature
   E) substituting 18:0 (stearic acid) in place of 18:2 (linoleic acid)

10. Integrins are:
   A) membrane proteins that mediate cell adhesion.
   B) membrane proteins that are involved in sugar transport.
   C) membrane proteins that are involved in ion transport.
   D) proteins of the extracellular matrix that bind to cell surface proteins.
   E) proteins that are found at the membrane-cytoplasm interface.

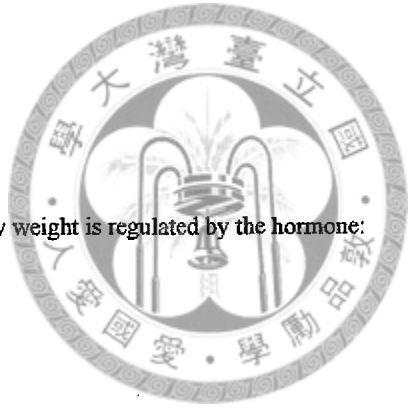
11. If beeswax (bw), cholesterol (ch), and phosphatidylglycerol (ph) were dissolved in chloroform, then subjected to thin-layer chromatography on silica gel using a mixture of chloroform/methanol/water as the developing solvent, which is the order of move (from fastest to slowest)?
   A) bw, ph, ch

接次頁

B) ch, bw, ph
C) ch, ph, bw
D) ph, bw, ch
E) bw, ch, ph

12. The maturation of insulin from its precursor (preproinsulin) involves:
A) acetylation.
B) disulfide exchange.
C) phosphorylation.
D) proteolysis.
E) reduction.

13. The tropic hormones (such as thyrotropin, somatotropin, and luteinizing hormone) are produced and released by the:
A) anterior pituitary.
B) hypothalamus.
C) adrenal gland.
D) pancreas.
E) posterior pituitary.



14. Long-term maintenance of body weight is regulated by the hormone:
A) adiposin.
B) hypothalmin.
C) leptin.
D) obesin.
E) testosterone.

15. The rate-limiting step in fatty acid synthesis is:
A) condensation of acetyl-CoA and malonyl-CoA.
B) formation of acetyl-CoA from acetate.
C) formation of malonyl-CoA from malonate and coenzyme A.
D) the reaction catalyzed by acetyl-CoA carboxylase.
E) the reduction of the acetoacetyl group to a β-hydroxybutyryl group.

16. Which of these can be synthesized by plants but *not* by humans?
A) Linoleate [18:2($\Delta^{9,12}$)]
B) Palmitate (16:0)
C) Phosphatidylcholine
D) Pyruvate
E) Stearate (18:0)

接背面

17. Which of these statements about the regulation of cholesterol synthesis is *not* true?
    A) Cholesterol acquired in the diet has essentially no effect on the synthesis of cholesterol in the liver.
    B) Failure to regulate cholesterol synthesis predisposes humans to atherosclerosis.
    C) High intracellular cholesterol stimulates formation of cholesterol esters.
    D) Insulin stimulates HMG-CoA reductase.
    E) Some metabolite or derivative of cholesterol inhibits HMG-CoA reductase.

18. Which of the following is *not* true of the reaction catalyzed by glutamate dehydrogenase?
    A) It is similar to transamination in that it involves the coenzyme pyridoxal phosphate (PLP).
    B) NH_4^+ is produced.
    C) The enzyme can use either NAD^+ or $NADP^+$ as a cofactor.
    D) The enzyme is glutamate-specific, but the reaction is involved in oxidizing other amino acids.
    E) α-Ketoglutarate is produced from an amino acid.

19. Glutamine synthetase is regulated by
    A) adenylylation
    B) allosteric regulation
    C) covalent modification
    D) feed-back inhibition
    E) all of the above

20. Regulation of ribonucleotide reductase in E. coli is unusual in that binding of effector molecules can regulate the enzyme's
    A) gene expression level
    B) mRNA stability
    C) activity and substrate specificity
    D) rate of protein degradation
    E) all of the above

21. Which of the statements about glucagon and insulin in the following is *not* true:
    A) Glucagon is secreted from the pancreatic α-cells and responds to both glucose and amino acids.
    B) However, unlike insulin, glucagon secretion is suppressed rather than stimulated by a rise in glucose concentration.
    C) Glucagon is synthesised initially as a larger protein called proglucagon.
    D) Insulin is synthesized initially as A-chain and B-chain linked by 2 disulfide bonds
    E) Insulin and glucagon are responsive to blood glucose levels.

22. For a tenfold difference in concentration the energy cost (ΔG) of moving 1 mol of an uncharged solute against concentration gradient at 25 ℃ is (R=8.315 J/mol.K)
    A) 5.7 kcal/mol
    B) 5.7 kJ/mol

接次頁

C) -5.7 kJ/mol
D) -57 kJ/mol
E) 2.48 kJ/mol

23. Double-stranded regions of RNA:
A) are less stable than double-stranded regions of DNA.
B) can be observed in the laboratory, but probably have no biological relevance.
C) can form between two self-complementary regions of the same single strand of RNA.
D) do not occur.
E) have the two strands arranged in parallel (unlike those of DNA, which are antiparallel).

24. The double helix of DNA in the B-form is stabilized by:
A) covalent bonds between the 3′ end of one strand and the 5′ end of the other.
B) hydrogen bonding between the phosphate groups of two side-by-side strands.
C) hydrogen bonds between the riboses of each strand.
D) nonspecific base-stacking interaction between two adjacent bases in the same strand.
E) ribose interactions with the planar base pairs.

25. B-form DNA in vivo is a _____-handed helix, _____ Å in diameter, with a rise of ____ Å per base pair.
A) left; 20; 3.9
B) right; 18; 3.4
C) right; 18; 3.6
D) right; 20; 3.4
E) right; 23; 2.6

26. Compounds that generate nitrous acid (such as nitrites, nitrates, and nitrosamines) change DNA molecules by:
A) breakage of phosphodiester bonds.
B) deamination of bases.
C) depurination.
D) formation of thymine dimers.
E) transformation of A → T.

27. Topoisomerases:
A) always change the linking number in increments of 1.
B) can act on single-stranded DNA circles.
C) change the degree of supercoiling of a DNA molecule but not its linking number of DNA.
D) occur in bacteria, but not in eukaryotes.
E) require energy from ATP.

接背面

28. It is correct to say that DNA supercoiling cannot:
    A) occur if a closed circular double-stranded DNA molecule has a nick.
    B) be induced by underwinding of the double helix.
    C) form if there is Z-DNA structure present.
    D) be induced by strand separation.
    E) result in compaction of the DNA structure.

29. In contrast to bacteria, eukaryotic chromosomes need multiple DNA replication origins because:
    A) eukaryotic chromosomes cannot usually replicate bidirectionally.
    B) eukaryotic genomes are not usually circular, like the bacterial chromosome is.
    C) the processivity of the eukaryotic DNA polymerase is much less than the bacterial enzyme.
    D) their replication rate is much slower, and it would take too long with only a single origin per chromosome.
    E) they have a variety of DNA polymerases for different purposes, and need a corresponding variety of replication origins.

30. The function of the eukaryotic DNA replication factor PCNA (*p*roliferating *c*ell *n*uclear *a*ntigen) is similar to that of the β-subunit of bacterial DNA polymerase III in that it:
    A) facilitates replication of telomeres.
    B) forms a circular sliding clamp to increase the processivity of replication.
    C) has a 3′→ 5′ proofreading activity.
    D) increases the speed but not the processivity of the replication complex.
    E) participates in DNA repair.

31. When bacterial DNA replication introduces a mismatch in a double-stranded DNA, the methyl-directed repair system:
    A) cannot distinguish the template strand from the newly replicated strand.
    B) changes both the template strand and the newly replicated strand.
    C) corrects the DNA strand that is methylated.
    D) corrects the mismatch by changing the template strand.
    E) corrects the mismatch by changing the newly replicated strand.

32. Which of the following are features of the wobble hypothesis?
    A) A naturally occurring tRNA exists in yeast that can read both arginine and lysine codons.
    B) A tRNA can recognize only one codon.
    C) Some tRNAs can recognize codons that specify two different amino acids, if both are nonpolar.
    D) The "wobble" occurs only in the first base of the anticodon.
    E) The third base in a codon always forms a normal Watson-Crick base pair.

33. Which one of the following is true about the genetic code?
    A) All codons recognized by a given tRNA encode different amino acids.
    B) It is absolutely identical in all living things.

接次頁

C) Several different codons may encode the same amino acid.
D) The base in the middle position of the tRNA anticodon sometimes permits "wobble" base pairing with 2 or 3 different codons.
E) The first position of the tRNA anticodon is always adenosine.

34. Which of the following statements about tRNA molecules is *false*?
A) A, C, G, and U are the bases present in the molecule.
B) Although composed of a single strand of RNA, each molecule contains several short, double-helical regions.
C) Any given tRNA will accept only one specific amino acid.
D) The amino acid attachment is always to a C nucleotide at the 3′ end of the molecule.
E) There is at least one tRNA for each of the 20 amino acids.

35. In the "activation" of an amino acid for protein synthesis:
A) leucine can be attached to $tRNA^{Phe}$, by the aminoacyl-tRNA synthetase specific for leucine.
B) methionine is first formylated, then attached to a specific tRNA.
C) the amino acid is attached to the 5′ end of the tRNA through a phosphodiester bond.
D) there is at least one specific activating enzyme and one specific tRNA for each amino acid.
E) two separate enzymes are required, one to form the aminoacyl adenylate, the other to attach the amino acid to the tRNA.

36. It is possible to convert the Cys that is a part of $Cys\text{-}tRNA^{Cys}$ to Ala by a catalytic reduction. If the resulting $Ala\text{-}tRNA^{Cys}$ were added to a mixture of (1) ribosomes, (2) all the other tRNAs and amino acids, (3) all of the cofactors and enzymes needed to make protein in vitro, and (4) mRNA for hemoglobin, where in the newly synthesized hemoglobin would the Ala from $Ala\text{-}tRNA^{Cys}$ be incorporated?
A) Wherever Ala normally occurs
B) Wherever Cys normally occurs
C) Wherever either Ala or Cys normally occurs
D) Wherever the dipeptide Ala-Cys normally occurs
E) Nowhere; this is the equivalent of a nonsense mutation

37. Which one of the following statements about eukaryotic RNA synthesis is correct?
A) Polymerase I is required for mRNA synthesis
B) α-amanitin can block polymerase I activity
C) All three polymerases need the same cofactors for transcription.
D) Termination of transcription requires the protein ρ factor.
E) The primary mRNA transcript is inactive.

38. A branched ("lariat") structure is formed during:
A) attachment of a 5′ cap to mRNA.
B) attachment of poly(A) tails to mRNA.
C) processing of preribosomal RNA.

D) splicing of all classes of introns.
E) splicing of group II introns.

39. Which one of the following statements about mRNA stability is true?
A) Degradation always proceeds in the 5′ to 3′ direction.
B) Degradation of mRNA by polynucleotide phosphorylase yields 5′-nucleoside monophosphates.
C) Secondary structure in mRNA (hairpins, for example) slows the rate of degradation.
D) Rates of mRNA degradation are always at least 10-fold slower than rates of mRNA synthesis.
E) In general, bacterial mRNAs have longer half-lives than do eukaryotic mRNAs.

40. Which statement is incorrect in eukaryotic mRNA maturation?
A) snRNPs are required for splicing of introns.
B) Energy inputs are required to drive the splicing process.
C) 5'-terminal cap structure is 7-methylguanosine joined to the mRNA via a 5′ → 5′ triphosphate linkage.
D) RNAs can be modified by adding or deleting bases in the coding regions.
E) Poly (A) tail is always added at the 3'end in cytosol.

41. Which one of the following statements about the reverse transcriptases of retroviruses and the RNA replicases of other single-stranded RNA viruses, such as R17 and influenza virus, is correct?
A) Both enzymes can synthesize either RNA or DNA from an RNA template strand.
B) Both enzymes can utilize DNA in addition to RNA as a template strand.
C) Both enzymes carry the specificity for the RNA of their own virus.
D) Both enzymes have error rates similar to those of cellular RNA polymerases.
E) Both enzymes require host-encoded subunits for their replication function.

42. "Housekeeping genes" in bacteria are commonly expressed constitutively, but not all of these genes are expressed at the same level (the same number of molecules per cell). The primary mechanism responsible for variations in the level of constitutive enzymes from different genes is that:
A) all constitutive enzymes are synthesized at the same rate, but are not degraded equally.
B) their promoters have different affinities for RNA polymerase holoenzyme.
C) some constitutively expressed genes are more inducible than others.
D) some constitutively expressed genes are more repressible than others.
E) the same number of mRNA copies are made from each gene, but are translated at different rates.

43. Protein amino acid side chains can hydrogen bond in the major groove of DNA, and discriminate between each of the four possible base pairs. In which one of the following groups of amino acids can all three members potentially be used in such DNA-protein recognition?
A) Asn, Glu, Lys
B) Arg, Gln, Leu
C) Asn, Gln, Trp
D) Ala, Asn, Glu
E) Glu, Lys, Pro

接次頁

44. Which of the following statements about regulation of the *lac* operon is true?
A) Glucose in the growth medium decreases the inducibility by lactose.
B) Glucose in the growth medium does not affect the inducibility by lactose.
C) Glucose in the growth medium increases the inducibility by lactose.
D) Its expression is regulated mainly at the level of translation.
E) The *lac* operon is fully induced whenever lactose is present.

45. Which of the following statements is true of the attenuation mechanism used to regulate the tryptophan biosynthetic operon in *E. coli*?
A) Attenuation is the only mechanism used to regulate the *trp* operon.
B) One of the enzymes in the Trp biosynthetic pathway binds to the mRNA and blocks translation when tryptophan levels are high.
C) The leader peptide plays a direct role in causing RNA polymerase to attenuate transcription.
D) Trp codons in the leader peptide gene allow the system to respond to tryptophan levels in the cell.
E) When tryptophan levels are low, the *trp* operon transcripts are attenuated (halted) before the operon's structural genes are transcribed.

46. An example of coordinate control is the down-regulation of ribosomal RNA synthesis in response to amino acid starvation, which will cause synthesis of ribosomal proteins to be limited. What is the correct order of the following events that participate in the signaling process?
1. Binding of stringent factor to the ribosome.
2. Formation of the unusual nucleotide ppGpp.
3. Formation of the unusual nucleotide pppGpp.
4. Uncharged tRNA binds in the ribosomal A-site.

A) 1, 4, 2, 3
B) 1, 4, 3, 2
C) 4, 1, 2, 3
D) 4, 1, 3, 2
E) 4, 2, 1, 3

47. Which one of the following statements about eukaryotic gene regulation is correct?
A) Large polycistronic transcripts are common.
B) Most regulation is positive, involving activators rather than repressors.
C) Transcription and translation are mechanistically coupled.
D) Transcription does not involve promoters.
E) Transcription occurs without major changes in chromosomal organization.

48. Which one of the following is *not* involved in steroid hormone action?
A) Cell surface receptors
B) Hormone-receptor complexes
C) Specific DNA sequences

接背面